

AMENDMENTS TO THE CLAIMS

Claims 1-56 were originally pending. Please amend claims 1-7, 9, 11-13, 15-16, 18, 20-30, 37, 39, 41-42, 46, and 48-49. Kindly cancel claims 8, 10, 19, 38, 45, 47, and 50-56 without prejudice. No claims have been added.

The following listing of claims replaces all prior versions, and listings of claims in the application.

Listing of Claims:

1. (Currently amended) A computer implemented method comprising:
for managing a multi-dimensional sleep queue, the managing method comprising:
inserting a thread into the multi-dimensional sleep queue; and
removing the thread from the multi-dimensional sleep queue.
identifying a thread of execution to insert into a sleep queue for a
predetermined amount of time;
responsive to the identifying, inserting the thread of execution into a first
dimension of the multi-dimensional sleep queue if:
 - (a) there is not a thread with a wake-up time equivalent to the
predetermined amount of time in the first dimension; and
 - (b) if there are one or more different threads of execution with the
wake-up time in a second dimension of the multi-dimensional sleep queue, each of
the one ore more different threads of execution has a thread priority lower than or
equal to a thread priority associated with the thread of execution.

1 2. (Currently amended) A computer implemented method as recited in
2 claim 1, wherein the multi-dimensional sleep queue is a real-time multi-
3 dimensional sleep queue.

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5 3. (Currently amended) A computer implemented method as recited in
6 claim 1, wherein the multi-dimensional sleep queue is a two-dimensional sleep
7 queue.

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9 4. (Currently amended) A computer implemented method as recited in
10 claim 1, wherein inserting a the thread of execution into the multi-dimensional
11 sleep queue is performed in a manner that allows a the thread scheduling
12 mechanism to schedule other threads for execution within a deterministic amount
13 of time.

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15 5. (Currently amended) A computer implemented method as recited in
16 claim 1, wherein inserting a the thread of execution into the multi-dimensional
17 sleep queue further comprises: inserting the thread of execution into the multi-
18 dimensional sleep queue such that a group of threads can be removed from the
19 multi-dimensional sleep queue in a deterministic amount of time.

1 6. (Currently amended) A computer implemented method as recited in
2 claim 1, wherein the multi-dimensional sleep queue comprises a group of threads,
3 and wherein the method further comprises:

4 removing the group of threads from the multi-dimensional sleep queue in a
5 deterministic amount of time, each thread in the group having a same wake-up
6 time.

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8 7. (Currently amended) A computer implemented method as recited in
9 claim 1;

10 wherein the ~~thread has~~ predetermined amount of time is a wake-up time,
11 and wherein the thread of execution has a priority; and

12 wherein inserting the thread of execution into the multi-dimensional sleep
13 queue further comprises:

14 ~~sorting the thread with respect to a~~ of execution into the first
15 ~~dimension of threads and a second dimension of threads, the first dimension of~~
16 ~~threads being sorted~~ based on respective thread wake-up times; and

17 sorting the thread of execution into the second dimension of threads
18 ~~being sorted~~ based on respective thread priorities; and

19 wherein the thread of execution being is sorted first with respect to
20 the first dimension and second with respect to the second dimension.

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22 8. (Canceled).

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24 9. (Currently amended) A computer implemented method as recited in
25 claim 7 ~~1~~, wherein the second dimension ~~of threads~~ comprises a plurality of

1 threads, each thread ~~in the second plurality of the threads~~ having a same respective
2 thread wake-up time.

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4 10. (Canceled).

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6 11. (Currently amended) A computer implemented method as recited in
7 claim 7, wherein sorting the thread of execution further comprises:

8 identifying a different thread in the first dimension ~~of threads~~ that has a
9 same wake-up time as equivalent to the new thread wake-up predetermined
10 amount of time; and

11 responsive to identifying the different thread:

12 concluding that a first priority corresponding to the ~~new thread~~ of
13 execution priority is higher than a second priority corresponding to the different
14 thread; and

15 replacing the different thread in the first dimension with the ~~new~~
16 thread of execution, such the ~~new thread~~ of execution is a member of both the first
17 and the second dimensions ~~of threads~~, and such that the replaced thread has a
18 secondary position with respect to the first and second dimensions ~~of threads~~.

1 12. (Currently amended) A computer implemented method as recited in
2 claim 7, wherein sorting the thread of execution further comprises:

3 identifying a different thread in the first dimension ~~of threads~~ that has a
4 ~~same~~ wake-up time as equivalent to the new thread wake-up predetermined
5 amount of time; and

6 responsive to identifying the different thread:

7 determining that a first priority corresponding to the ~~new~~ thread of
8 execution is lower than a second priority that corresponds to the different thread;
9 and

10 inserting the ~~new~~ thread of execution into the second dimension ~~of~~
11 ~~threads~~, such the ~~new~~ thread of execution occupies a secondary position with
12 respect to the first and second dimensions ~~of threads~~ and such that any different
13 thread in the second dimension with lower priority than the first priority is
14 subsequent in position to the secondary position.

1 13. (Currently amended) A computer-readable medium—~~comprising~~
2 ~~computer-executable instructions for:~~ managing a multi-dimensional sleep queue,
3 the computer-readable medium comprising computer-executable instructions for:
4 ~~instructions for managing comprising:~~

5 ~~inserting a thread into the multi-dimensional sleep queue; and~~
6 ~~removing the thread from the multi-dimensional sleep queue.~~
7 identifying a thread of execution to insert into a sleep queue for a
8 predetermined amount of time;

9 responsive to the identifying, inserting the thread of execution into a first
10 dimension of the multi-dimensional sleep queue if:

11 (a) there is not a thread with a wake-up time equivalent to the
12 predetermined amount of time in the first dimension; and

13 (b) if there are one or more different threads of execution with the
14 wake-up time in a second dimension of the multi-dimensional sleep queue, each of
15 the one ore more different threads of execution has a thread priority lower than or
16 equal to a thread priority associated with the thread of execution.

17 14. (Original) A computer-readable medium as recited in claim 13,
18 wherein the multi-dimensional sleep queue is a real-time multi-dimensional sleep
19 queue.

20 15. (Currently amended) A computer-readable medium as recited in
21 claim 13, wherein the computer-executable instructions for inserting a the thread
22 of execution into the multi-dimensional sleep queue are performed in a manner
23 that allows a the thread scheduling mechanism to schedule other threads for
24 execution in a deterministic amount of time.
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2 16. (Currently amended) A computer-readable medium as recited in
3 claim 13, wherein the computer-executable instructions for inserting a the thread
4 of execution into the multi-dimensional sleep queue further comprise instructions
5 for: inserting the thread of execution into the multi-dimensional sleep queue such
6 that a group of threads can be removed from the multi-dimensional sleep queue in
7 a deterministic amount of time.

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9 17. (Original) A computer-readable medium as recited in claim 13,
10 wherein the multi-dimensional sleep queue comprises a group of threads, and
11 wherein the computer-executable instructions further comprise instructions for:

12 removing the group of threads from the multi-dimensional sleep queue in a
13 deterministic amount of time, each thread in the group having a same wake-up
14 time.

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16 18. (Currently amended) A computer-readable medium as recited in
17 claim 13, wherein the ~~thread has~~ predetermined amount of time is a wake-up time,
18 and wherein the thread of execution has a priority; and

19 wherein the computer-executable instructions for inserting the thread of
20 execution into the multi-dimensional sleep queue further comprise instructions for:

21 sorting the thread of execution into the second dimension ~~of threads~~
22 ~~being sorted~~ based on respective thread priorities; and

23 wherein the thread of execution ~~being~~ is sorted first with respect to
24 the first dimension and second with respect to the second dimension.

1 19. (Canceled).

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3 20. (Currently amended) A computer-readable medium as recited in
4 claim ~~18~~ 13, wherein the second dimension ~~of threads~~ comprises a plurality of
5 threads, each thread ~~in the second plurality of the threads~~ having a same respective
6 thread wake-up time.

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8 21. (Currently amended) A computer-readable medium as recited in
9 claim ~~18~~ 13, wherein the thread of execution is a new thread, and wherein the
10 instructions for ~~sorting~~ inserting the thread of execution further comprise
11 instructions for:

12 determining that ~~a wake-up~~ the predetermined amount of time
13 ~~corresponding to the new thread~~ is different as compared to each respective wake-
14 up time of each other thread in the first dimension ~~of threads~~;

15 responsive to the determining, introducing the new thread into the first
16 ~~dimensions~~ dimension.

1 22. (Currently amended) A computer-readable medium as recited in
2 claim 18, wherein the computer-executable instructions for sorting the thread
3 further comprise instructions for:

4 identifying a different thread in the first dimension ~~of threads~~ that has a
5 ~~same~~ wake-up time as equivalent to the new thread wake-up predetermined
6 amount of time; and

7 responsive to identifying the different thread:

8 concluding that a first priority corresponding to the ~~new~~ thread of
9 execution ~~priority~~ is higher than a second priority corresponding to the different
10 thread; and

11 replacing the different thread in the first dimension with the ~~new~~
12 thread of execution, such the ~~new~~ thread of execution is a member of both the first
13 and the second dimensions ~~of threads~~, and such that the replaced thread has a
14 secondary position with respect to the first and second dimensions ~~of threads~~.

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16 23. (Currently amended) A computer-readable medium as recited in
17 claim 18, wherein the computer-executable instructions for sorting the thread
18 further comprise instructions for:

19 identifying a different thread in the first dimension ~~of threads~~ that has a
20 ~~same~~ wake-up time as equivalent to the new thread wake-up predetermined
21 amount of time; and

22 responsive to identifying the different thread:

23 determining that a first priority corresponding to the ~~new~~ thread of
24 execution is lower than a second priority that corresponds to the different thread;
25 and

1 _____inserting the new thread of execution into the second dimension of
2 threads, such the new thread of execution occupies a secondary position with
3 respect to the first and second dimensions of threads and such that any different
4 thread in the second dimension with lower priority than the first priority is
5 subsequent in position to the secondary position.

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7 24. (Currently amended) A computer implemented method for managing
8 a multi-dimensional sleep queue comprising:

9 inserting a new thread into the multi-dimensional sleep queue using a
10 multi-dimensional atomic walk procedure; and

11 removing the new thread from the multi-dimensional sleep queue for
12 insertion into a run queue.

1 25. (Currently amended) A computer implemented method as recited in
2 claim 24, wherein inserting the new thread further comprises:

3 if the new thread is a first thread, setting a last examined thread to reference
4 the new thread, the last examined thread being used to identify an insertion point
5 for the new thread.

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7 26. (Currently amended) A computer implemented method as recited in
8 claim 24, further comprising:

9 removing a group of threads from the multi-dimensional sleep queue in a
10 deterministic amount of time.

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12 27. (Currently amended) A computer implemented method as recited in
13 claim 24, further comprising:

14 removing a group of threads from the sleep queue in a deterministic amount
15 of time, each thread in the group of threads having a same wake-up time.

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17 28. (Currently amended) A computer implemented method as recited in
18 claim 27, wherein the deterministic amount of time is independent of a number of
19 threads in the group of threads.

1 29. (Currently amended) A computer implemented method as recited in
2 claim 24, wherein the multi-dimensional sleep queue comprises at least one other
3 thread, and wherein inserting the new thread further comprises:

4 establishing a thread insertion point in the multi-dimensional sleep queue
5 for the new thread; and

6 introducing the new thread into the multi-dimensional sleep queue at the
7 insertion point.
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9 30. (Currently amended) A computer implemented method as recited in
10 claim 29, wherein establishing the thread insertion point further comprises:

11 determining if a status of a last examined thread has changed, the status
12 indicating either that the last examined thread was removed from the multi-
13 dimensional sleep queue, or indicating that the last examined thread was moved
14 from a first dimension of threads that is sorted based on respective thread wake-up
15 times, to a second dimension of threads that is ordered based on respective thread
16 priorities;

17 if the status of the last examined thread has changed, searching for the
18 thread insertion point from a beginning of the multidimensional sleep queue; and

19 if the status of the last examined thread has not changed, searching for the
20 thread insertion point from the last examined thread.
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1 31. (Original) A computer-readable medium comprising computer-
2 executable instructions for managing a sleep queue, the computer executable
3 instructions comprising instructions for:

4 inserting a new thread into the sleep queue using a multi-dimensional
5 atomic walk procedure; and

6 removing the new thread from the sleep queue for insertion into a run
7 queue.

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9 32. (Original) A computer-readable medium as recited in claim 31,
10 wherein instructions for inserting the new thread further comprise instructions for:

11 if the new thread is a first thread, setting a last examined thread to reference
12 the new thread, the last examined thread being used to identify an insertion point
13 for the new thread.

14
15 33. (Original) A computer-readable medium as recited in claim 31,
16 further comprising instructions for:

17 removing a group of threads from the sleep queue in a deterministic amount
18 of time.

19
20 34. (Original) A computer-readable medium as recited in claim 31,
21 further comprising instructions for:

22 removing a group of threads from the sleep queue in a deterministic amount
23 of time, each thread in the group of threads having a same wake-up time.

1 35. (Original) A computer-readable medium as recited in claim 34,
2 wherein the deterministic amount of time is independent of a number of threads in
3 the group of threads.

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5 36. (Original) A computer-readable medium as recited in claim 31,
6 wherein the multi-dimensional sleep queue comprises at least one other thread,
7 and wherein the instructions for inserting the new thread further comprise
8 instructions for:

9 establishing a thread insertion point in the multi-dimensional sleep queue
10 for the new thread; and

11 introducing the new thread into the multi-dimensional sleep queue at the
12 insertion point.

1 37. (Currently amended) A computer-readable medium as recited in
2 claim 36, wherein the instructions for establishing the thread position further
3 comprise instructions for:

4 determining if a status of a last examined thread has changed, the status
5 indicating either that the last examined thread was removed from the multi-
6 dimensional sleep queue, or indicating that the last examined thread was moved
7 from a first dimension of threads that is sorted based on respective thread wake-up
8 times, to a second dimension of threads that is ordered based on respective thread
9 priorities;

10 if the status of the last examined thread has changed, searching for the
11 thread insertion point from a beginning of the multidimensional sleep queue; and

12 ——if the status of the last examined thread has not changed, searching
13 for the thread insertion point from the last examined thread.

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15 38. (Canceled).
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1 39. (Currently amended) A system for managing a sleep queue, the
2 system comprising:

3 a memory comprising computer-executable instructions and a multi-
4 dimensional sleep queue; and

5 a processor operatively coupled to the memory for executing the computer-
6 executable instructions, the computer-executable instructions comprising
7 instructions for:

8 ~~inserting a thread into the multi-dimensional sleep queue; and~~

9 ~~removing the thread from the multi-dimensional sleep queue.~~

10 identifying a thread of execution to insert into a sleep queue for a
predetermined amount of time;

11 responsive to the identifying, inserting the thread of execution into a first
12 dimension of the multi-dimensional sleep queue if:

13 (a) there is not a thread with a wake-up time equivalent to the
14 predetermined amount of time in the first dimension; and

15 (b) if there are one or more different threads of execution with the
16 wake-up time in a second dimension of the multi-dimensional sleep queue, each of
17 the one ore more different threads of execution has a thread priority lower than or
18 equal to a thread priority associated with the thread of execution.

19 40. (Original) A system as recited in claim 39, wherein the multi-
20 dimensional sleep queue is a real-time multi-dimensional sleep queue.
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1 41. (Currently amended) A system as recited in claim 39, wherein the
2 instructions for inserting the thread of execution are performed in a manner that
3 allows a thread scheduling mechanism to schedule other threads for execution in a
4 deterministic amount of time.

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6 42. (Currently amended) A system as recited in claim 39, wherein the
7 instructions for inserting the thread of execution further comprise instructions for:
8 inserting the thread of execution into the multi-dimensional sleep queue
9 such that a group of threads can be removed from the multi-dimensional sleep
10 queue in a deterministic amount of time.

11
12 43. (Original) A system as recited in claim 39, wherein the multi-
13 dimensional sleep queue further comprises a group of threads, and wherein the
14 computer executable instructions further comprise instructions for:
15 inserting the group of threads into the multi-dimensional sleep queue; and
16 removing the group of threads from the multi-dimensional sleep queue in a
17 deterministic amount of time, each thread in the group having a same wake-up
18 time.

1 44. (Currently amended) A system as recited in claim 39, wherein the
2 thread has a wake-up time and a priority, and wherein the instructions for inserting
3 the thread further comprise instructions for:

4 sorting the thread ~~with respect to a~~ of execution into the first
5 ~~dimension of threads and a second dimension of threads, the first dimension of~~
6 ~~threads being sorted~~ based on respective thread wake-up times; and

7 sorting the thread of execution into the second dimension of threads
8 ~~being sorted~~ based on respective thread priorities; and

9 wherein the thread of execution being is sorted first with respect to the first
10 dimension and second with respect to the second dimension.

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12 45. (Canceled).

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14 46. (Currently amended) A system as recited in claim 44, wherein the
15 second dimension ~~of threads~~ comprises a plurality of threads, each thread ~~in the~~
16 ~~second plurality~~ of the threads having a same respective thread wake-up time.

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18 47. (Canceled).

1 48. (Currently amended) A system as recited in claim 44, wherein the
2 instructions for sorting the thread of execution further comprise instructions for:

3 identifying a different thread in the first dimension ~~of threads~~ that has a
4 ~~same~~ wake-up time as equivalent to the new thread wake-up predetermined
5 amount of time; and

6 responsive to identifying the different thread:

7 concluding that a first priority corresponding to the ~~new~~ thread of
8 execution ~~priority~~ is higher than a second priority corresponding to the different
9 thread; and

10 replacing the different thread in the first dimension with the ~~new~~
11 thread of execution, such the ~~new~~ thread of execution is a member of both the first
12 and the second dimensions ~~of threads~~, and such that the replaced thread has a
13 secondary position with respect to the first and second dimensions ~~of threads~~.

1 49. (Currently amended) A system as recited in claim 44, wherein the
2 instructions for sorting the thread of execution further comprise instructions for:

3 identifying a different thread in the first dimension ~~of threads~~ that has a
4 ~~same~~ wake-up time as equivalent to the new thread wake-up predetermined
5 amount of time; and

6 responsive to identifying the different thread:

7 determining that a first priority corresponding to the ~~new~~ thread of
8 execution is lower than a second priority that corresponds to the different thread;
9 and

10 _____inserting the ~~new~~ thread of execution into the second dimension ~~of~~
11 ~~threads~~, such the ~~new~~ thread of execution occupies a secondary position with
12 respect to the first and second dimensions ~~of threads~~ and such that any different
13 thread in the second dimension with lower priority than the first priority is
14 subsequent in position to the secondary position.

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16 50-56. (Canceled).